

**PLANAR SUBSTRATE BASED FUEL CELL MEMBRANE ELECTRODE  
ASSEMBLY AND CIRCUITRY**

**ABSTRACT**

[0048] Disclosed is a Polymer Electrolyte Membrane (PEM) fuel cell Membrane Electrode Assembly (MEA) apparatus constructed on a planar substrate. The substrate provides mechanical support for the MEA and also facilitates the inclusion of further integrated circuitry operably coupled to the MEA. Also disclosed is integrated circuitry providing MEA fuel cells with self-contained control circuitry, as well as integrated circuitry with self-contained fuel cell power sources. The invention also provides increased MEA performance and reduced cost as a result of the reduced thickness of the electrolyte material.

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